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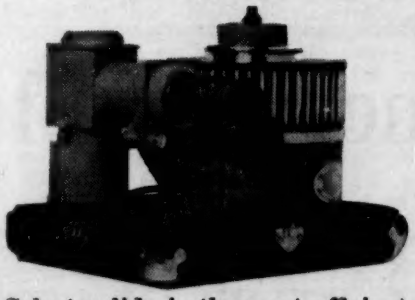

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METALS IN NATIONAL DEFENSE[1]

By Dr. ZAY JEFFRIES

GENERAL ELECTRIC COMPANY

WHEN near the middle of 1940, the Advisory Commission to the Council of National Defense was established, it was only natural that great stress was put on the importance of metals and minerals and equally natural that Dr. C. K. Leith should find himself in the center of this activity. Dr. Leith has made a profound study of the relationships between minerals and war. He has served the government, directly and indirectly, for more than a quarter of a century and, for the past twenty years, he has advocated the stockpiling of such minerals as are not obtainable or of which there is a deficiency in the Western Hemisphere. He has eloquently pointed out that the nations controlling the great mineral deposits of the world should lead in both industrial and war strength; that no continent is self-sufficient in all the minerals necessary for either a complete industrial development or the most efficient prosecution of war; that the mineral distribution is such that no continent can obtain all the necessary minerals without sea transportation, and hence that the value of sea control can hardly be overestimated.

Dr. Leith early called on the National Academy of Sciences for technologic help on manganese and tin. By February, 1941, the problems were multiplying to such an extent that he asked the academy to arrange for a comprehensive organization to provide the Office of Production Management, successor to the Advisory Commission, with advice on metals and minerals.

Dr. Frank B. Jewett, the president of the academy,

[1] Read at the meeting of the National Academy of Sciences, Madison, Wisconsin, October 14, 1941.

created such an organization known as the Advisory Committee on Metals and Minerals of the National Academy of Sciences and the National Research Council. Mr. Clyde Williams, head of Battelle Memorial Institute, Columbus, Ohio, is chairman—and a most able one. The committee has been subdivided into four main groups, as follows:

Ferrous Minerals and Ferro-Alloys Group
Chairman, Gilbert E. Seil, 11 members
Non-Metallic Minerals Group
Chairman, R. P. Heuer, 12 members
Tin Smelting and Reclamation Group
Chairman, F. W. Willard, 6 members
Metals Conservation and Substitution Group
Chairman, Zay Jeffries, 27 members

Problems on which advice is sought originate in OPM and clear through Dr. Leith to Mr. Williams, who makes the specific assignments to the proper group. Studies are made and reports are prepared which are submitted to OPM through Dr. Jewett. In the preparation of reports, help is sought from the most authoritative sources, including individuals, universities, companies, government agencies and bureaus and independent laboratories. It is a pleasure to report that all these groups have cooperated splendidly. They not only have given of their time and energy but have literally opened the archives of their confidential information. I hope that after this terrible international storm has passed there will be given adequate recognition of such service.

Even in a brief statement of this work it should be pointed out how effective is the administration of the committee work by Dr. Jewett. His broad experience in administering technical matters, together with his jealous guardianship of the prerogatives, functions and reputation of the academy, combine to make him the ideal leader of this undertaking.

Some of the committee reports are confidential, some are confidential in part, and others are available for release to interested parties. In the short time allowed for this presentation, only a few high spots can be covered. Being more familiar with the group of which I am chairman, I shall confine my remaining remarks to the work of the Metals Group. Any opinions offered are personal.

Before the complete organization of the Metals Group on March 15, 1941, we had responded to an urgent request from Dr. Leith for a report on the nickel situation. A shortage was not only impending, it was at hand. To date, twenty-three other formal reports have been submitted. Still other reports are being prepared, and no end of problems seems in sight while the emergency lasts.

To gain some idea of the scope of the studies, it may suffice to name the metals on which formal reports have been or are being made. These include nickel, aluminum, magnesium, zinc, chromium, manganese, vanadium, tungsten, molybdenum, copper, tin, antimony, cadmium, lead, cobalt, mercury, iridium, ruthenium, low-alloy structural steels, die castings and steel and cast-iron rolls. Other reports cover specific processes relating to one or more of these metals.

The OPM has specialists on each of the major metals, and our committee cooperates closely with them. The metal pictures change so rapidly that it is necessary to contact these specialists at intervals to avoid working on obsolete phases of the metal problems. By working on the right problems our group helps OPM to a better understanding of the metal requirements for both defense and non-defense and, it is hoped, toward a wiser administration of the metal allocations.

The steps taken last March to ease the nickel shortage, by substitutions, put an added burden on other metals such as chromium, copper, vanadium, etc. A threatened aluminum shortage put a heavier load on copper and zinc, among other metals, and a zinc shortage still further strained the copper supply. A shortage in one metal tends to eat into the stocks of other metals.

Because the steel production is ten times that of all other metals combined, it has taken much of the substitution load and, in the end, it must provide the lion's share of any substantial increase in metal consumption. Now, steel is scarce. A few months ago it seemed as if lead would be plentiful. Unavailability of such metals as copper, zinc and aluminum in sufficient quantities to meet the large non-defense demands has finally resulted in an acute lead shortage.

Thus the story of the past six months has been one of a succession of metal shortages encompassing all the major metals. Of the important defense metals, the supply of molybdenum alone seems to be ample. If the emergency lasts a year or two longer we may look for a shortage of molybdenum.

To make the situation worse, there is the criticism that our stock-piles of essential metals are too low. This is true, but the critics are displaying hindsight wisdom and not foresight wisdom such as is found in Dr. Leith's recommendations over the past twenty years. Large stock-piles of strategic metals can not be built up during a world war. The substantial accumulations must be made in peace-time, and authorizations were not adequate until it was too late.

Are things actually as bad as this recitation sounds? Are the shortages real? Is there a ray of light ahead? Surely we do not want to be complacent in the midst of a program calling for every constructive effort; but neither should we become hysterical and lose our

sense of proportion. In pointing out some of the brighter facets I shall try to steer the middle course between complacency and hysteria.

First, the shortages are not caused by a lower supply, but by a greatly increased demand. The supplies of the various metals are the greatest in history. Some of the minor metals are available in amounts exceeding twice the normal consumption. Even the steel production is 25 per cent. above that for a reasonably good peace-time year. For the past twelve months the people of the United States have been on a buying spree. Fear of shortage and fear of higher prices both induce buying for future use. The extent of purchases beyond immediate needs is unknown, but, judging from spot checks, this must have been an important factor in the large demand.

When it is realized, however, that this tremendous non-defense use of metals has been concurrent with a major program of building and equipping defense plants, the wonder is not that shortages appeared but that it was possible to provide metals for both activities. As the defense plants are brought into production they will naturally require a larger percentage of the metals, but they will also need a larger percentage of the labor, transportation, electrical energy and many services, thus tending to lessen dislocation resulting from the curtailment of the use of metals in non-defense industries.

Another favorable factor is the quality of the available alloys. The supply of steel-alloying elements, such as nickel, chromium, molybdenum, vanadium and even manganese, is so much greater than normal that a larger percentage of alloy steel is being made than ever before. The enhanced quality of the alloy steels not only makes possible more war material from a given tonnage, but it will make our munitions, all along the line, superior to those of the Axis Powers. So, to the greatest metal quantity of all time we can add the highest average quality of all time.

Now, a few words about the stock-piles. Notwithstanding the late start and the war conditions, stocks of some of the most strategic metals have been accumulated. While these stocks are not nearly as large as desired, they are large enough to cushion any sudden blow, and they have been built under most trying circumstances. Then there is additional comfort on the stock-pile matter. Because we have been for years the greatest industrial nation and have consumed more metal than any other country, we have the greatest of all stores—the metals in use. Except for normal scrap recovery, we have never really drawn from this vast store of metal because we have never had the need to do so. This reservoir can be tapped to almost any extent required by the emergency. For example, if aluminum is desperately needed, 100,000,000 pounds can be drawn off in a few weeks.

Again, we have watched the succession of shortages, but have we learned anything from the experience? Yes, we have learned much. We have found that in many places non-metals, such as plastics, glass, fabric, wood, etc., can be substituted, at least temporarily, for metals. We have seen that, although there are places in which the use of a particular metal is well-nigh indispensable, there are sufficient uses of nearly all the metals in which a wide variety of substitutions of other metals can be made so that all the available metal can be consumed. It is concluded from this that increases in the supply of any metal help the whole situation. The increases can be made where expansion is easiest, cheapest or soonest. This gives assurance that steel expansion will solve many of the shortages in non-ferrous metals, at least during the emergency. This is, indeed, an important conclusion.

Another important factor is over-expectation on the part of the inexperienced. The American people are in the habit of expecting miracles in production. Vast numbers of automobiles, electrical appliances and the like come streaming from the factories without seeming effort or delay. Who thinks about the long periods of research, of trial-and-error, of machine development, of process perfection, of training skilled workers and the many other steps which necessarily preceded the production flow? In the transformation from a peace-time to a defense economy, time-consuming groundwork must also be laid. Part of it has been done, but there is still much of it left to do. Progress eventually must be rated on what comes off the production line, but at the moment it must be judged by the soundness of the preparations. They are sounder than many people think.

Let us elaborate somewhat on this. Special emphasis has been given in the press to the so-called aluminum shortage. During the five years ending with 1939, the average new aluminum consumption in the United States was 256,000,000 pounds annually. Current production is at an annual rate of around 700,000,000 pounds. Obviously, there is no shortage from the standpoint of normal demand. But aluminum is the key to aircraft production, and aircraft production must be still further increased. Therefore, a further expansion in aluminum output will be necessary. Now, one can make some new aluminum, by the thimbleful, in the laboratory in a day's time. But we need it in magnitudes of additional hundreds of millions of pounds. Mining operations must be expanded, new electrical machinery built, great new chemical plants must be erected and equipped, new transportation facilities must be provided, etc., all of which will require time. After all these things are done, production miracles will be performed. And so it is with much of the defense production. The

public should understand these things and, understanding, they will have greater confidence in what is being done.

Certain other factors having a bearing on the metal problem should be mentioned:

1. Industry requires more metal during a period of expanding production than after the expansion is completed. The plant stocks must be increased both ahead of and in the production line. Industry has been expanding during the past year or more, and part of the apparent metal shortage has been used to fill these plant "pipe lines."
2. Plant inventories, in raw material, material in process and finished product, are not known. The fear complex should stimulate late rather large inventories, and spot checks tend to confirm this view. In general, capacities and inventories are apt to be underestimated and requirements overestimated.
3. Much equipment, labor and material, such as in the machine-tool industry, are now being extensively used to prepare defense plants for production. When the defense plants are tooled up, these facilities will be liberated, in part, for direct defense production.
4. Plans are under way all along the line to expand the production of the primary metals. The magnitudes range from millions of tons of pig iron and steel, down.

In an effort to appraise all these factors, good and bad, I venture the following opinions:

a. There will be ample metal for the greatest defe production of all time.
b. In addition, there will be ample metal to keep all the essential services, including food, heat, li transportation, communication, water and gas.
c. There will be a considerable amount of metal civilian uses ordinarily regarded as non-essential defense.
d. The kind of metal available for many civilian will in many cases represent impairment, but the i paired products will serve well during the emerge
e. Many of the substitutions will probably have long-range effect on many products and proces and, perhaps, even on habits.

In conclusion, it may be interesting to record i pressions gained from many personal contacts duri the past six months and covering most phases of t metal industry. In general, the people having th least confidence in our ability to produce are tho farthest from the production lines. They are the on with little information about what is actually goi on and little comprehension of what it takes to rea produce. On the other hand, the men in the storm center of production—executives, engineers, scientist foremen and skilled workmen—have unbounded fait that our defense production will greatly surpass an thing the world has ever seen. Assuming that th latter group is the better qualified to pass judgme we are, even now, in great need of unity of purpos and action lest this vast production comes too late.

THE METHOD OF CO-TWIN CONTROL

By Dr. ARNOLD GESELL
YALE UNIVERSITY

Growth is an irreversible process. In investigating the growth process one might like to train a child, and then compare him with what he would have been if he had not received the training. This can not be done; there is no way to make the desired comparison. But we may study a pair of identical twins with just such comparisons in mind. We may train one twin (T) experimentally, and reserve the co-twin (C) as a control. C becomes a scientific kind of stand-in-double for T.

In 1927 the writer, in collaboration with Dr. Helen Thompson, undertook a comparative study in which two highly identical twin girls, T and C, were observed from early infancy to determine, first, their developmental correspondence and, secondly, their developmental divergence, as affected by training confined to one twin. A thoroughgoing similarity in physical and behavioral characteristics was amply established by repeated examinations and measurements.[1, 2]

The method of co-twin control had its origin in a stair-climbing and cube-behavior experiment begun when twins T and C were 46 weeks old. Twin T was trained daily in climbing a 5-tread staircase. At 52 weeks she climbed the staircase in 26 seconds. Twin C, at the age of 53 weeks, without any previous training or experience, climbed the same staircase unaided in 45 seconds. As a comparative check, Twin C was then trained for a period of 2 weeks. At the age of 55 weeks she climbed the stairs in 10 seconds. The climbing performance of Twin C at 55 weeks was far superior to that of Twin T at 52 weeks, even though Twin T had been trained 7 weeks earlier and three times longer. At 56 weeks and again at 3 years their performance on the experimental staircase was amazingly alike. These clear-cut quantitative results, sup-

[1] Arnold Gesell, "The Developmental Psychology of Twins." From A Handbook of Child Psychology. Worcester, Mass.: Clark Univ. Press, 1931. Ed. Carl Murchison, pp. 158–203.

[2] Arnold Gesell and Helen Thompson, *Genet. Psychol. Monog.*, 6: 1–124, 1929.

ported by minutely analyzed cinema records, established certain relationships between learning and maturity.

In a similar way for a period of 6 weeks, Twin T was trained and stimulated in exploitive play with ten one-inch red blocks. Every effort was made to perfect and to elaborate her patterns of cube behavior. Twin C again was reserved as an untrained control. Detailed analysis of cinema records showed a remarkable similarity in the cube behavior of the twins at 46, 52, 63 and 79 weeks of age.

In a later study Strayer[3] used the same co-twin control method to determine the relative efficacy of early and deferred vocabulary training. The twins were separated and kept under continuous observation. Twin T was trained from her 84th to 89th week. Twin C was trained for 4 weeks beginning with the 89th week. C reached a higher level of language performance after 28 days than did T after 35 days of training. T was only slightly superior at 93 weeks; three months later the difference was negligible.

When the twins were 4½ years old, Hilgard[4] used the co-twin control method to compare the effects of early and delayed practice in motor and memory performances—ring tossing, walking board skill, digit and object memory and paper cutting. Three months and also six months after practice, the performances of the twins on all tests were as similar to each other as at the beginning of the experiment.

Through an exceptionally fortunate convergence of circumstances it has been possible to follow the development of these self-same twins for 14 years. Numerous observations and coincident comparisons were made at advancing ages. Simultaneous observation with segregation of the twins was accomplished by a duplex non-communicating suite, equipped at the end with a single one-way-vision window. The findings of these studies and of the several co-twin control experiments have been coordinated in a recent monograph which reviews the life careers of the twins for the whole period from early infancy to adolescence.[5] Both physical and behavioral characteristics were considered as follows: (1) *Anthropometry:* height and weight, palm prints, dentition, hair and eye color, hair histology, vision, hearing, health, eating and sleeping, puberty, homeostasis. (2) *Motor Behavior:* postural demeanors, laterality, locomotion, fine coordination. (3) *Adaptive Behavior:* mental growth rates, block construction, play behavior, drawing, school achievement. (4) *Language Behavior:* infant vocalizations, enunciation, vocabulary, conversation. (5) *Personal-Social Behavior:* adjustments to home and school, inter-twin dominance, humor, fantasy, personality traits.

This sequential study represents a biogenetic application of the combined methods of co-twin control and coincident comparison, to determine the stability of behavior resemblances and differences. The long reach of the data, with numerous nodes for cross comparison, made it possible to analyze such factors as ontogenetic timing, physiological tempo, attentional traits and the durability of individualities of behavior and personality. So far as Twins T and C are concerned many of our conclusions seem firmly grounded.

Some of the conclusions may be safely generalized. But the method of co-twin control has its limitations. A twin is not an absolute unit of measurement; and we must start all over again with the next pair of twins. In this sense, twins are uncalibrated and fall outside the calculus of biometrics. Nevertheless, when one reflects that even physics with its beautiful mathematical precisions is never on absolutely absolute ground, we may accord a certain pragmatic value to a method which applies a norm that equals in complexity the phenomena to which the norm is applied.

The distinctive feature of the method of co-twin control is its utilization of an organismic norm. Such a norm has certain advantages over a purely statistical criterion. Statistical norms and devices can never be organismic because they are either heterogeneously unselected or homogeneously selective and must therefore remain analytic and partial in application. But a control co-twin is by definition highly identical with the individual under investigation. He is in fact the sum of a statistically numerous multitude of forces. He is an embodied quantity who with respect to any distinguishable trait is more or less than the investigated individual.

A control co-twin is a synthetic standard of comparison with a highly equivalent prenatal and postnatal life career, except for divergences which are experimentally created or naturalistically observed. When one contemplates the almost infinite number of variables which enter into the shaping of any life career, it must be granted that an "identical" co-twin who brings these variables into finite and manageable range is indeed an extraordinarily powerful statistic in his own integral person. His individuality is unique, but by definition it is almost a replica of the individuality which is being assayed. The patterns of twin and co-twin do not exactly superimpose. But by matching we measure. We expose areas and directions of discrepancy. The almost complete identity of the datum and the measuring device gives augmented significance to all discrepancies which can be defined and accounted for.[6]

[3] L. C. Strayer, *Genet. Psychol. Monog.*, 8: 209–319, 1930.

[4] J. R. Hilgard, *Genet. Psychol. Monog.*, 14: 493–667, 1933.

[5] Arnold Gesell and Helen Thompson, *Genet. Psychol. Monog.*, 24: 3–121, 1941.

[6] Arnold Gesell, SCIENCE, 88: 2280, 225–230, 1938.

With such a rationale it is evident that the method of co-twin control requires that a thorough parity and identity be established by careful measurements *prior* to the period of comparative observation and experiment. If there are any significant antecedent discrepancies they should be recorded and taken into account in subsequent comparisons. H. H. Newman in an interesting chapter on the psychology of twins has called attention to the importance of this aspect of the method of co-twin control. Referring to the New York twins, Johnny and Jimmie, he writes:

> One of these twins, we don't remember which and it doesn't matter, was trained to be a little gentleman and the other allowed to grow up like Topsy. As time went on they became very different in motor skills and in social behavior. This would have been an excellent case for testing the effects of different environment and training on two individuals alike in their heredity, except for one defect in the setup. Johnny and Jimmie turned out to be a pair of two-egg twins! So the co-twin control feature was entirely lacking and therefore the experiment was meaningless. . . .[7]

Newman properly points out that unless one-egg twins are used it is impossible to distinguish hereditary from environmental effects. Galton had the same thought in mind, when in 1875 he wrote his famous paper entitled "The History of Twins as a Criterion of the Relative Powers of Nature and Nurture."[8]

The method of co-twin control presupposes one-egg twins of thoroughgoing similarity, with environmental factors held constant, except for precisely defined or experimentally imposed differentiations.

The method of co-twin control therefore is essentially a clinical method, designed for the intensive study of monozygotic pairs (to say nothing of monozygotic triplets, quads or quints!). It can attain statistical status, in the ordinary sense of that term, only when a sufficiently large number of comparable co-twin control studies are accumulated. Such a statistical extension of the method was advocated in 1930 by Blakeslee and Banker in a paper entitled "Identical Twins as Biological Controls in Educational and Other Human Problems."[9] The authors suggested an endowed school for one-egg twins instructed by monozygotic twin teachers! Just at this time, Russia organized an institute for twin research in connection with the Maxim Gorky Medico-Biological Institute of Moscow. The method of co-twin control was used on a systematic scale for a large variety of studies. A score of scientists pooled their resources and in 1935 some 800 pairs of twins, mostly children, had been investigated. This striking enterprise resulted in significant studies, but was terminated about three years later.[10, 11]

Although these large-scale investigations are impressive, it should be pointed out that the method is not essentially enhanced by multiplication. A large number of cases may confirm trends and define new problems; but numbers will not in themselves be productive. The method is clinical; it is productive in the single instance. It depends heavily upon the ingenuity and insight of the experimenter; and it is capable of far-reaching adaptations. The areas of possible application have scarcely been scratched. The method has numerous potentialities in the field of medicine, which already boasts a vast literature on twins and twinning phenomena. The medical literature, however, is largely documentary, rather than experimental. Co-twin control has many unrealized applications in clinical physiology, pharmacology and experimental therapeutics.[12]

The method of co-twin control is peculiarly suited to the analytic study of the processes of child development and the genetic factors of life-career. If the instincts of an organism were only tinted pink and the habits robin egg blue, as Lloyd Morgan whimsically wished, then we might better grasp the relationships of nature and nurture, of endowment and environment. This differential stain has not been forthcoming; but with the aid of co-twin control studies we may glimpse the interrelations of learning and growth, the effects of specific training, the influence of attitudes and emotional patterns. The method may be fruitfully used to explore these intricate problems which are so resistant to absolute biometric approach. The method preserves the togetherness of the individual and affords more insight into the total integrated economy of performance and development. Critically used it is to a considerable degree self-corrective.

When so used we come, in the end, to a better understanding not only of one individual but of two, for one reciprocally elucidates the other. When the comparisons are made successively over a long ontogenetic range, this comparative method also illumines the processes of growth. Differences and correspondences in timing establish points to reckon by. And even though the method is one of dead reckoning and lacks the elegance of classic mensuration, it may bring a mariner shrouded in shifting fogs to the vicinity of a port.

[7] H. H. Newman, "Multiple Human Births. Twins, Triplets, Quadruplets and Quintuplets." New York: Doubleday Doran. xi + 214 pp., 1940.

[8] Francis Galton, *Jour. of the Anthropological Institute*, 5: 391–406, 1876.

[9] A. F. Blakeslee and H. J. Banker, *Proceedings of the American Philosophical Society*, Vol. 69, 1930.

[10] S. G. Levit, *Character and Personality*, 3: 188–193, 1935.

[11] A. R. Luria, *ibid.*, 5: 35–47, 1936.

[12] Arnold Gesell (with Eugene Blake), *Archives of Ophthalmology*, 15: 6, 1050–1071, 1936.

OBITUARY

KARL M. WIEGAND

DR. KARL M. WIEGAND, for many years head of the department of botany at Cornell University and professor emeritus of botany since August, 1941, died at Ithaca, N. Y., on Thursday, April 12. Burial was at Truxton, New York. He is survived by his wife and one daughter.

Professor Wiegand was born in the village of Truxton, N. Y., on June 2, 1873. This was his home until he entered Cornell University. Influenced no doubt by his father, who was a pharmacist of the scholarly type, he developed an interest in his natural surroundings. As a boy of fifteen, by working on difficult plant groups, he was already demonstrating interest and ability in problems in taxonomy. In an Atlas of Cortland County owned by his family appear notations of his early searches and expeditions to the various valleys, hills and swamps of that beautiful region.

Truxton being a small village and only about 30 miles from Ithaca by a branch railroad, he went to Ithaca High School to prepare himself for entrance to Cornell, with the intention of specializing in pharmacy. Just previous to his entrance into the university the course in pharmacy was abolished. Nevertheless, he entered Cornell and here began his formal education in botany. This he selected as his major subject, and in accordance with the requirements for graduation submitted a thesis. The subject of this thesis was seed anatomy, and the quality of the investigation was of such a character that it gained for him election to Sigma Xi. He graduated from Cornell with the B.S. degree in 1894.

Following his graduation he became assistant in the department of botany and began graduate studies. His early interests were diverse and included physiology, anatomy and morphology, but he continued his special interest in taxonomy. Despite his early work in taxonomy and his special interest in this field, his thesis was concerned with frost injury of buds and his purpose at this time was to specialize in plant physiology. The Ph.D. degree was granted to him in 1898 and the following year he was promoted to the rank of instructor. It was not until 1900 in the "Announcement of Courses" that his name appears associated with instruction in taxonomy.

In 1907 Dr. Wiegand accepted a position at Wellesley College as associate professor of botany. Here he taught elementary botany and taxonomy until 1913 and during this period made taxonomy his major field of work.

Largely through the efforts of Dr. Liberty Hyde Bailey, then dean of the College of Agriculture at Cornell, a new Department of Botany was organized in the College of Agriculture in 1913. Dr. Wiegand was made head of this new department, which within a few years absorbed the Department of Botany of the College of Arts and Sciences.

For a period of twenty-eight years, until his retirement in August, 1941, he wisely guided the department and was largely responsible for bringing the department to its high reputation. At Cornell he was free to follow his chosen field and confined his research and teaching to taxonomy. Despite the pressure of administrative duties he found time to develop from very little a herbarium of about 250,000 specimens. This alone would have been an achievement, but in addition he gave liberally of his time to the identification of plants for botanists from all parts of the country. His enthusiasm for the subject of taxonomy was contagious. Countless students were inspired by him to become interested in plants and to appreciate the value of taxonomic studies in their practical and cultural aspects. When it was realized a little over a year ago that Dr. Wiegand was to retire, his courses in taxonomy became filled to capacity. These students wanted to be taught by the master.

His desire to do research was manifest early in life and continued to the end. Despite the multitude of other duties associated with his position he found time for research. He published more than one hundred papers. His intensive field studies of the plants of the Cayuga Lake region resulted ultimately in the publication of the "Cayuga Lake Flora," prepared in association with Dr. A. J. Eames. The excellence of this work has resulted in the general acceptance of this publication as the model of its kind. He made a notable contribution to horticulture by preparing for Bailey's Standard Cyclopedia the extensive and technical "Synopsis of the Vegetable Kingdom" and by his assistance in the preparation of the Introductory Key. He was recognized as one of the leading taxonomists of the world.

Dr. Wiegand was vice-president of Section G of the American Association for the Advancement of Science in 1933 and in 1939 he was president of the Botanical Society of America. For a period of eleven years following the World War, he directed the Summer School in Biology at Cornell, which attracted many students.

Dr. Wiegand was a very modest man who loved his fellow men. He was unselfish to a degree seldom found in men. He viewed his research problems objectively and was always ready to forsake his own views when convinced of the validity of concepts proposed by others. His quiet cheerfulness, his high ideals and his thoughtful consideration of others

endeared him to his students, to his colleagues and to all who were associated with him.

LEWIS KNUDSON

CORNELL UNIVERSITY

DEATHS AND MEMORIALS

VERNON BAILEY, from 1887 until his retirement in 1933 chief field naturalist of the Biological Survey, U. S. Department of Agriculture, died on April 20 in his seventy-eighth year.

DR. EDWARD ROYAL WARREN, from 1909 to 1918 director of the Museum of Colorado College, died on April 20, at the age of eighty-one years.

DR. F. M. PAGAN, chairman of the department of biology of the University of Puerto Rico, who had been serving as exchange professor of botany at Duke University, died on April 15.

DR. GUSTAVE WHYTE THOMPSON, chief chemist and director of the National Lead Company, retired, died as the result of an automobile accident, on April 22. He was seventy-six years old.

THE death on March 13, at the age of sixty-five years, is announced of Captain Guy Dollman, assistant keeper of zoology in the British Museum (Natural History).

A SERIES of lectures has been established at Columbia University as a memorial to Dr. Frederick J. E. Woodbridge, Johnsonian professor of philosophy, from 1912 to 1929 dean of the Graduate Faculties, who died on June 1, 1940. Professor Wilmon H. Sheldon, of the department of philosophy of Yale University, has been appointed the first lecturer.

SCIENTIFIC EVENTS

PROTECTION AGAINST FOREST FIRES

W. S. ROSENCRANS, of Los Angeles, president of the American Forestry Association, has submitted to President Roosevelt a resolution passed by the board of directors of the association at a meeting recently held in Washington.

The resolution calls upon all conservation agencies and forest users—federal, state and private—to "dedicate their undivided efforts to the doing of those things that are clearly of first importance within their field in promoting the common cause of victory." In the forest field the association holds that three lines of action now claim and should have undisputed priority. They are:

Protection of forest and related resources and of war industries, including power, water and transportation lines essential to their operation, against the impending danger of forest fires. This is an immediately critical threat to our war efforts: first, because in addition to normal forest fire hazards, sabotage by our enemies of our production of wood, our supply lines, and operation of war industries through widespread setting of forest fires by aerial bombing and ground incendiarism is not only possible but probable this summer; and, second, because adequate preparedness against such a contingency is not now assured. The danger is particularly acute on the Pacific Coast where vital war industries are concentrated and from which our prosecution of the war in the Pacific is based.

Maintenance of continuous production of wood and other forest products essential to the prosecution of the war. Most of the war industries, the training of our armed forces and the shipment of supplies and equipment to the fighting fronts of the United Nations is dependent in large part upon an uninterrupted production and delivery of wood in raw and fabricated forms.

Accelerated research in the use and production of cellulose, plywood, lumber and other forest products related to war needs. Such research will not only promote the conservation of our forest resources but it will strengthen and speed our war effort by providing improved equipment and by helping to overcome shortages in other materials that are now or may in the future impede war action.

"We believe," the resolution concludes, "that the accomplishment of these objectives is vital to the winning of the war and that they should have the united and supreme effort of all individuals and groups in the forest field. To this end we urge that highly controversial issues, such as federal regulation of privately owned timberlands, be set aside until the war is won, without prejudice as to their merit or desirability when normal conditions of American life are reestablished."

EXPEDITION OF THE NEW YORK ZOOLOGICAL SOCIETY

The New York Times has received word from Caripito, Venezuela, to the effect that Dr. William Beebe's forty-second expedition was ready on March 23 to start explorations into the dense Venezuelan jungle near the settlement.

The expedition, which is being conducted under the auspices of the Department of Tropical Research of the New York Zoological Society, has headquarters on the edge of the jungle in the modern camp of the Standard Oil Company of Venezuela. Electricity, baths, good food, talking pictures, swimming pool and golf course and a well-equipped laboratory are at the disposal of the unit, all less than twenty minutes away from the wilderness that Mr. Beebe has studied in his eight years in British Guiana.

The expedition has made preparatory incursions

into the jungle and is getting its implements and test-tubes in order while waiting for the rainy season. One of the mysteries of the jungle is where the birds, animals and reptiles disappear during the hot, dry months of winter. Nevertheless, it is reported that the party has seen howling monkeys, tapirs, tigers, ferocious wild boars, deadly bushmaster and coral snakes, anteaters and sloths.

Dr. Beebe is chiefly interested in studying the evolution of animals in the Venezuelan jungle, which are similar to the species he studied in British Guiana. The expedition, financed by the Simon Guggenheim Foundation, includes Miss Jocelyn Crane, research zoologist; Henry Fleming, entomologist; George Swanson, artist, and Mary Vander Pyl, field associate. Miss Vander Pyl has not yet joined the staff, but will do so shortly. The expedition will remain in Caripito for six months. Part of the time will be spent on a houseboat on the San Juan River, a haven of strange bird species found in no other part of the world.

THE BIOLOGICAL RESEARCH INSTITUTE OF THE ZOOLOGICAL SOCIETY OF SAN DIEGO

THE Zoological Society of San Diego announces the renewal of two research fellowships available to advanced graduate students of either sex for research work at the Biological Research Institute in the fields of bacteriology, parasitology, veterinary medicine, food preservation and other problems related to national defense. The stipend of each fellowship is $1,000 per annum.

The Zoological Hospital and Research Institute is supported by public appropriations and endowed funds, and is devoted to problems concerned with the health and normal life of animals, in and out of captivity, and to other phases of biological research. It is conducted in connection with the San Diego Zoological Gardens which houses 3,000 animals, including 175 species of mammals, 500 species of birds and 150 species of reptiles.

Research facilities include a two-story building with individual laboratory and office rooms. Refrigeration, incubation, x-ray and microphotographic apparatus, microtomes, microscopes, etc., are available in the building. An extensive outdoor animal isolation yard houses all new animals and research material. New animals are continually arriving from different parts of the world. There is a wealth of material for pathological, bacteriological, parasitological and anatomical study from the zoological gardens and other cooperating agencies.

The Biological Research Institute is not directly affiliated with any university, but qualified students may make arrangements to work for an advanced degree under the jurisdiction of cooperating universities. Only the thesis or dissertation requirements or parts thereof can be fulfilled at the Biological Research Institute. Preference will be given to advanced graduate students. Information in regard to these fellowships will be sent on request. Applications should be addressed before May 15 to Dr. Frank D. McKenney, Biological Research Institute, Balboa Park, San Diego, California.

THE COLD SPRING HARBOR SYMPOSIUM ON QUANTITATIVE BIOLOGY

THE tenth annual symposium at the Cold Spring Harbor Biological Laboratory will be held from June 10 to June 20. The subject to be considered this year is "The Relation of Hormones to Development." Topics for presentation and discussion will include: hormones of micro-organisms; hormone-controlled processes in insect development; analysis of eye-color differentiation in Drosophila; relation of organizers to development; natural influences and formative effects induced with hormone-like substances in higher plants; chemistry of hormones; relation of vitamins to hormones; hormones and photoperiodism; pituitary hormones affecting development in higher animals; the gonadotrophic and thyrotrophic hormones; hormonal control of embryo and seedling; endocrine factors in atypical growths; induction and prevention of abdominal fibroids by steroid hormones; formative influence of carcinogenic substances; hormonal regulation of development in lower vertebrates; hormonal control of differentiation in birds; hormones and the growth of the parts of the urinogenital apparatus in mammalian embryos; hormones as dedifferentiating agents; the role of hormones in senescence; hormones and overgrowths.

Invitation papers on these topics will be presented by twenty-two investigators from the United States, Canada and South America. Copies of the program will be sent on request. All papers and prepared discussions will subsequently be published as Volume X of the Cold Spring Harbor Symposia on Quantitative Biology.

All who are interested may attend the symposium and take part in the informal discussion of papers without further invitation. In addition, the Biological Laboratory offers its facilities for biological and biophysical research to participants in the symposium and to other investigators throughout the summer.

THE AMERICAN ASSOCIATION OF CEREAL CHEMISTS

THE annual meeting of the American Association of Cereal Chemists will be held at the Edgewater Beach Hotel, Chicago, from May 18 to 21. The sessions have been arranged under the following subjects: Agronomy and milling technology; statistical clinic;

cake, biscuit and cracker technology; laboratory baking methods; malting and brewing; protein symposium; bread baking technology; general analytical methods; symposium on flour and bread nutritional supplements. While it is not possible to give all the details of the program, attention should be drawn to the opportunity for cereal chemists to discuss their statistical problems in the statistical clinic, which consists of a joint session of the association with the Biometric Section of the American Statistical Association.

At the opening session, Dr. T. R. Hogness, of the University of Chicago, will discuss respiratory enzymes and their relationship to some of the vitamins; Dr. C. H. Goulden, of the Dominion Rust Research Laboratory of Winnipeg, Manitoba, will present a paper entitled "Experimental Design for Cereal Chemists," and Dr. R. M. Hixon, of Iowa State C lege, will give an address on "Starch."

At one of the general sessions, Dr. R. A. Gortn of the University of Minnesota, will give the Osbo Medal Award address. It will be entitled "The Pl Proteins."

Among the speakers at a general session im diately preceding the symposium will be Dr. C. Elvehjem, of the University of Wisconsin. He w speak on "The Water Soluble Vitamins"; Dr. R. Williams, of the Bell Telephone Laboratories of N York, will discuss the "Progress of Flour and Br Enrichment"; Mrs. Clara Gebhard Snyder, of t Wheat Flour Institute, will discuss "Enriched Fl as the Consumer Sees It."

In all, sixty-four papers and addresses have b listed, covering a wide range of subjects.

SCIENTIFIC NOTES AND NEWS

DR. EDWIN GRANT CONKLIN, professor of biology emeritus of Princeton University, was elected on April 24 president of the American Philosophical Society to succeed the Honorable Roland S. Morris. Dr. Conklin has been vice-president of the society since 1932 and executive officer since 1936.

ON the occasion of the celebration in Boston, on April 17, of the one hundred fiftieth anniversary of the founding of the Massachusetts Society for Promoting Agriculture, the medal of the society was awarded for his botanical services to Dr. Elmer D. Merrill, director of the Arnold Arboretum and administrator of Botanical Collections, Harvard University.

DR. HENRY BUTLER ALLEN, director of the Franklin Institute, Philadelphia, has been awarded a George A. Hoadley certificate to mark the completion of a quarter of a century of active service with the institute.

THE William Osler Medal of the American Association of the History of Medicine has been awarded to John T. Barrett, of the School of Medicine of Boston University. The presentation will take place at the annual meeting, which will be held in Atlantic City on May 3, 4 and 5.

AMONG those on whom honorary degrees were conferred by the Jewish Theological Seminary of New York, at exercises in commemoration of the one thousandth anniversary of Saadia Gaon, the Hebrew philosopher, was Dr. Arthur H. Compton, Charles H. Swift distinguished service professor of physics at the University of Chicago.

DR. ALEXANDER WETMORE, assistant secretary of the Smithsonian Institution, and Dr. Edward Chapin, curator of the Division of Insects of t U. S. National Museum, have been elected correspon ing members of the Academia Columbiana de Cienci Exactas, Fisico-Quimicas y Naturales.

DR. J. B. TYRRELL, consulting mining engineer Toronto, has been elected a senior fellow of the Ge logical Society of London. Dr. Tyrrell has been member of the society for sixty years.

OFFICERS elected at the annual meeting of t American Society for Pharmacology and Exper mental Therapeutics are: *President,* E. K. Marshal Jr., the Johns Hopkins University; *Vice-president* Carl A. Dragstedt, Northwestern University; *Secre tary,* Raymond N. Bieter, University of Minnesot *Treasurer,* Erwin E. Nelson, Tulane University *Councillors,* McKeen Cattell, Cornell University Ralph G. Smith, University of Michigan.

PROFESSOR GORDON ALLPORT, chairman of the de partment of psychology of Harvard University, w elected president of the Eastern Psychological Asso ciation, at its recent meeting at Brown University Other officers elected were: Dr. Theodora M. Abel Thiells, N. Y., *Secretary;* Dr. Kurt Goldstein, Tuft Medical School, *Member of the Program Committee* and Professor Gardner Murphy, College of the City of New York, and Dr. Otto Klineberg, Columbi University, *Directors.*

AT the recent annual meeting of the Supervisory Board of the American Year Book, an organization sponsored by forty-five learned societies, Professor Marston Taylor Bogert, of Columbia University, th representative of the American Chemical Society, wa

elected to the presidency. Rear Admiral George H. Rock (C.C.), U.S.N. retired, representing the Society of Naval Architects and Marine Engineers, was elected to the vice-presidency.

AT the meeting of the American Institute of Nutrition in Boston on April 1, the following officers for the coming year were elected: *President,* L. A. Maynard; *Vice-president,* H. B. Lewis; *Secretary,* A. H. Smith; *Treasurer,* W. H. Sebrell, Jr.; *Councillor,* T. H. Jukes.

DR. WALTER BRADFORD CANNON, George Higginson professor of physiology at Harvard University, and Dr. Reginald Aldworth Daly, Sturgis-Hooper professor of geology, will retire with the title emeritus on September 1.

CHANCELLOR WILLIAM P. GRAHAM, professor of electrical engineering and dean of the College of Applied Science of Syracuse University and since 1937 chancellor of the university, having reached the age of seventy years, has presented his resignation to the board of trustees to take effect within a year. Dr. Graham accepted the office of chancellor in 1937 for a period of one year or until his successor should be appointed.

DR. JOHN H. MUELLER, associate professor of bacteriology and immunology in the Harvard Medical School, Boston, has been named professor of bacteriology and immunology, the appointment to be effective on July 1. He will also take charge of the department at the Medical School and at the School of Hygiene and Public Health. Dr. Fuller Albright, medicine; Dr. Allan M. Butler, pediatrics, and Dr. Hiram H. Merritt, neurology, have been promoted to associate professorships. Dr. Fredrick J. Stare, who graduated at the University of Chicago School of Medicine in 1941, has been appointed assistant professor of nutrition.

Museum News reports that William L. Corbin, librarian of the Smithsonian Institution and custodian of the Smithsonian deposit in the Library of Congress since 1924, retired in January. He is succeeded by Mrs. Austin H. Clark, assistant librarian in the U. S. National Museum.

AS has been already announced in SCIENCE, the decision of the council of the Zoological Society, London, that the post of secretary be temporarily suspended, has been challenged by an informal committee of fellows of the society. The committee states that it "disapproves of the action of the council in attempting to terminate Dr. Julian Huxley's appointment as secretary to the society during his absence abroad with the council's permission."

DR. M. F. MORGAN, head of the department of soils in the Connecticut Agricultural Experiment Station at New Haven, has been called to active duty as Lieutenant Colonel of Infantry in the United States Army. Dr. Herbert A. Lunt will be acting head of the department of soils during Dr. Morgan's absence. Edward Rubins, of Rutgers University, has been appointed research assistant in soils.

DR. FRANK E. EGLER, assistant professor, New York State College of Forestry, Syracuse, N. Y., has leave of absence for the present semester in order to carry on ecologic investigations in British Honduras and Guatemala. He left New Orleans on February 14 and will return in September.

THE past and future of trans-ocean communication were reviewed before the Institution of Electrical Engineers, London, on April 23 in a paper prepared for the thirty-third Kelvin Lecture by Dr. Oliver E. Buckley, president of the Bell Telephone Laboratories, New York. Since Dr. Buckley could not attend in person, he had recorded a brief sound-picture. After he had appeared on the screen before the audience in London, his paper was read by Sir Stanley Angwin, vice-president of the institution.

THE second Robert J. Terry Lecture of the Washington University Medical Alumni Foundation was delivered on April 22 by Dr. George Bernays Wislocki, Parkman professor of anatomy at the Harvard Medical School. His subject was "The Primate Placenta, with Particular Reference to the Trophoblast."

DR. DENNIS R. HOAGLAND, head of the division of plant nutrition at the University of California College of Agriculture, delivered, during April, at the School of Biology of Harvard University, under the auspices of the Prather Foundation, a series of five lectures on the "Inorganic Nutrition of Plants."

THE fifty-second annual meeting of the Ohio Academy of Science was held on April 16, 17 and 18 under the presidency of Dr. Eugene Van Cleef, professor of geography at the Ohio State University. His presidential address was entitled "The City of Tomorrow."

THE Louisiana and New Orleans Academies of Sciences are holding a joint meeting in New Orleans, at the St. Charles Hotel, on May 1 and 2. The Junior Academies of the two organizations will meet at the same time with exhibits on Friday and papers on Saturday. Dr. Carl G. Hartman, of the department of zoology of the University of Illinois, is the guest speaker at the banquet.

A NEW series of short-wave broadcasts was inaugurated under the auspices of the American Philosophical Society on April 24 over the non-commercial short-wave radio station WRUL. A series of addresses was arranged, each by an authority in his

special field. It is planned that the significance of American thought and achievement in the present crisis in our civilization form the general background of the series. Dr. Robert A. Millikan, chairman of the executive council of the California Institute of Technology, gave the first thirty-minute program. The proceedings were opened by the Honorable Roland S. Morris, retiring president of the society. Dr. Edwin G. Conklin, the newly elected president, was the principal speaker. Walter Lemmon, president of WRUL, and Sir Angus Fletcher, consultant on programs addressed to the British Empire, also spoke.

THE Brush Foundation of the Western Reserve University School of Medicine has received from the General Education Board of the Rockefeller Foundation a supplementary grant of $15,000 for one year to be used in completing its study of the growth and development of adolescent children. This study was begun in 1935 by the late Dr. T. Wingate Todd and has been continued by Dr. William Walter Greulich, director of the Brush Foundation and professor of physical anthropology and anatomy in the School of Medicine.

BY the will of Charles H. Hastings, the major part of his estate is left, in memory of his father, Charles Cook Hastings, to establish a foundation for the prevention and treatment of tuberculosis. The estate is reported to amount to more than two million dollars. After payment of annuities to friends and servants, the entire estate will go to the foundation. It is provided that the Charles Cook Hastings Home be built either on "several large parcels of property near Beaumont, Calif.; Banning, Calif.," or on the Mesa Alta Ranch, near Pasadena, which he owned. The will instructs the executors to build a sanatorium to be conducted and maintained on a strictly charitable basis.

WILLIAM R. WARNER AND CO., INC., of New York, has given funds for a two-year fellowship for study in the department of radiology at the Long Island Medical School, Brooklyn, N. Y. Grants have also been made to the New York University Medical School for the study of the conjugation of the sulfonamide drugs, to be carried out in the Pneumonia Service of the Harlem Hospital; to Northwestern University Medical School, Chicago, to investigate the possibilities of detoxifying therapeutic agents used in the practice of dermatology; and to the Washingtonian Hospital, Boston, for the study of alcoholism. This study will involve the blood chemistry and psychometric findings of cases while under the influence of alcohol and during recovery.

THE facilities of Iowa State College have been accepted by the United States Navy for the establishment of a Naval Training School for Electricians. Beginning about June 1, eight hundred men at a time will receive sixteen weeks of training; the continuous program will probably last throughout the war. The departments of electrical engineering, mechanical engineering, mathematics and physics will provide instruction.

DISCUSSION

THE PALEONTOLOGICAL COLLECTIONS AT THE UNIVERSITY OF CINCINNATI

FOR better than forty years the University of Cincinnati has been bringing together a representative collection of the world-famous Cincinnatian (Ordovician) fossils. There was a time when it was all too true that the Cincinnati community slept while her unrivalled paleontologic heritage was scattered over the world and when no satisfactory collection existed or was available in the city. This was the state of affairs as late as 1902, when J. M. Nickles, in his "Geology of Cincinnati," quite rightly deplored the situation. Happily, most of the early collections, the basis for much of the early descriptive work, remained in the country, at least, and are preserved for all time in such institutions as the U. S. National Museum, the Museum of Comparative Zoology, the American Museum of Natural History, the Walker Museum and other great centers of geological research. Now, after more than four decades of concerted effort, a research collection that is thoroughly representative has been amassed and safely preserved in Cincinnati's municipal University Museum.

With the acquisition by gift in the fall of 1941 of the collection of E. H. Vaupel, the last of the old-time private collections in the Cincinnati area finds a safe harbor. Mr. Vaupel is the last local survivor of that "age of giants" in the last century when the wonders of Cincinnati's hills were first being made known to science. His enthusiasm for fossils grew from his early association with S. A. Miller, Charles Dury, Charles Schlemmer, Charles Faber, August Foerste and Drs. George Austin and George Twitchell, all of whom stayed their days out on the Cincinnati uplift. His first inspiration for "dry-dredging" came from his youthful acquaintance with Edward Ulrich, of Covington and now of Washington, and Professor Charles Schuchert, another Cincinnati lad, now emeritus at Yale University. Beginning his cabinet in the

closing days of the "golden era," Vaupel's collection contained few types of original descriptions of the Cincinnati fauna, but has a very real compensatory asset in having been made after stratigraphic details and zonation were worked out. It comes in very large part from abandoned quarries and worked-out localities—many topotypic, and apparently lost forever to science. With a thorough knowledge of the usual run of Cincinnatian fossils, his chief interest was to discover new extensions of range, new localities and new forms. Herein lies the great scientific worth of the Vaupel collection. The inventory and cataloguing of Mr. Vaupel's collection proceeds apace, and within the year most of the thousands of specimens will be allocated to their proper niches in the fireproofed permanent research collections of the University of Cincinnati.

Fortunately for Cincinnati geologists, not all the historically famous old collections left their home area, as for a while it seemed likely they would. In 1889 the University of Cincinnati received the U. P. James collection by bequest. Although the bulk of the James types had gone elsewhere, this was the nucleus of type materials and research collections that have been added to with the years. The residue of the S. A. Miller collection was purchased from his heirs in 1917, some twenty years after Miller's death. Although much of the type material had been sold to other institutions by that time, some 2,000 types were discovered by painstaking comparisons when the collection was inventoried for the 1936 catalogue of the University of Cincinnati Museum types. Not all these type materials pertain to the Cincinnatian, however. Thousands of research specimens were added by the gift of the Charles Schlemmer collection, Dr. Twitchell's specialized collection of specimens and thin-sections of bryozoans and stromatoporids, an early collection of bryozoans and micro-fossils made by Mr. Vaupel, and the great general Cincinnatian collection that Charles Faber amassed in his later years. Faber's collection went to the university with an endowment sufficient to insure a permanent research curator of paleontology and a generous publication fund for paleontology at the University Museum.

Early in 1942 arrangements were completed by which the very extensive fossil collection of the Cincinnati Society of Natural History will be on deposit at the University Museum, where it will be thoroughly restudied, catalogued and made available for researchers. For better than three quarters of a century this collection has been growing; its quality is considerably better than one might anticipate from the statement made by Nickles in 1902 that "the paleontological collection of the Cincinnati Society of Natural History consists mainly of odds and ends which have come to it piecemeal." Those "odds and ends" are a large number of old-time local collections and much foreign material acquired years ago by exchange. It apparently embraces a good many type specimens which have been in essence lost to science until now. The collection contains as well a splendid array of rare and undescribed specimens that were added "piecemeal." The society is to be congratulated for having kept its collection intact through the years, even though not sponsoring paleontological research or having facilities for exhibiting extensive fossil materials. Cincinnatians are especially grateful to the society for keeping the collection permanently in the city, and particularly for making it available at this time, which is one of great recrudescence of local paleontologic interest.

In addition to these invaluable older collections which have come to the University of Cincinnati by gift and purchase, the faculty and students of the Department of Geology and Geography have been for many years assiduously collecting fossils and data from the disappearing old-time sites in the Cincinnati hills, the while keeping pace with new exposures and excavations. An enormous aggregate of research material is the result. Thus generosity and industry have in part redeemed the loss of many early collections, and a truly rich representation of Cincinnatian paleontology and the necessary comparative materials are now preserved in Cincinnati. There they await the long years of research ahead before the store of knowledge is exhausted and the full story of the Cincinnatian epoch told.

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ORIGIN OF THE TERM "EUTHENICS"

IN my article on "The Term 'Euthenics,'"[1] I discussed the possibility of a wider adoption of the term. Since then question as to its origin has been raised, and I have asked Dr. C. B. Davenport, who was one of the first American advocates of its use, to make a statement on that subject. He writes:

> You may recall that in June, 1910, Mrs. E. H. Harriman announced her plan to start the Eugenics Record Office and the newspapers made quite a good deal of it at the time. Mrs. Ellen H. Richards soon thereafter prepared a small book entitled "Euthenics" (with a subtitle, "The Science of Controllable Environment") and some time later a course in euthenics was given at Vassar. So far as I know Mrs. Richards was the first to use this term.

Mrs. Richards pointed out that the concept was well defined by the Greeks and appeared in two forms:

[1] SCIENCE, 94: 2450, 561–562.

eutheneo (Demosthenes, Aristotle, Herodotus) and *euthenia* (Herodotus).

CARL E. SEASHORE

NORWEGIAN MEMBERS OF THE ROYAL SOCIETY OF GÖTEBORG

IT may interest readers of SCIENCE to hear that a petition subscribed by practically all members of the R. Society of Göteborg resident in the city has been presented to the Swedish minister for foreign affairs asking him to intervene in favor of three Norwegian members of the R. Society who have been illegally imprisoned and subjected to severe treatment by the present authorities in Norway. The following is a translation from the Swedish original, which carried the signatures of fifty-two members:

To his Excellency the Minister for Foreign Affairs:

Three foreign members of the Royal Society of Science and Letters of Göteborg, *viz.*, the principal of the University of Oslo, Didrik Arup Seip, and the professors of the same university, Anton Wilhelm Brögger and Francis Bull, have already for a considerable time been deprived of their liberty. They are known to us as eminent scientists and scholars and are citizens beyond reproach. As far as we know none of them has been convicted of any crime against the laws of their country by a legal court of justice or even been accused of any criminal offence.

To all of us their fate has given great pain. The fact that Professor Seip, for reasons unknown to us, has been subjected to a treatment of inhuman cruelty has further increased our anxiety on their behalf.

We subscribed members of the Royal Society resident in Göteborg herewith apply to your Excellency with the request that everything in your power shall be done in order to set our fellow members at liberty and enable them to resume their studies and research.

It is greatly to be feared that any action taken by the Swedish government according to the request will be void of effect under present circumstances.

HANS PETTERSTON,
Member of the R. Society of Göteborg

MARCH 2, 1942

THE SCHOOL OF MEDICINE OF THE UNIVERSITY OF GEORGIA—A CORRECTION

A MISLEADING note as to the situation in the Medical School of the University of Georgia appeared in SCIENCE of March 20. This note implies that several of our faculty members have been dismissed for advocating coeducation of negro and white students. None of our faculty has been dismissed and the coeducation question has not been raised on our campus. The regents have given us every possible financial aid and encouragement in living up to the standards set by the American Medical Association. We have done so and will continue to do so.

Action was taken by the council without investigating the merit of the school or of its graduates. It was apparently based upon the action of a legally constituted board of regents in dismissing administrative officers in schools in other parts of the state. Fortunately, this action does not affect the diplomas of students now in school or those entering before September first. Our dean was told by Dr. Wilbur with the full membership of the council present that no reflection was being cast upon the teaching and research of the school. Unfortunately, this was not made public.

W. F. HAMILTON

UNIVERSITY OF GEORGIA

QUOTATIONS

RUSSIAN INTERCHANGE

WE look forward when the war is over to enjoying happy relations with the Russians and to that vigorous exchange of scientific and artistic thought which is the best part of comradeship, whether between men or nations. In the meantime we are anxious to contribute in every way we can to the strength of their arms and their defences; and for the medical profession the course is plain: we would like to put at their disposal whatever information may be useful, and to find whatever equipment they need.

Something has already been done in both directions by the Anglo-Soviet Medical Committee; the appeal made by Sir Alfred Webb-Johnson, president of the committee, for surgical instruments has met with a good response which he acknowledges on another page; instruments worth about £3000 have reached him and less than 10 per cent. of these required repair. Those in perfect condition were greased and forwarded at once, while those needing overhaul or replating are being put quickly in order. A subcommittee dealing with medical supplies have been advising Mme. Maisky, wife of the Soviet Ambassador, on the purchase of surgical instruments, x-ray sets, autoclaves and other equipment, and during the past three months seventy large cases of instruments, some weighing a quarter of a ton, have been dispatched. In addition, Sir Philip Manson-Bahr and Mr. G. F. Home are compiling a book for the committee, probably to be called "Reviews of British War Medicine," consisting of articles by recognized authorities. This is being translated into Russian by doctors who have volunteered for the task and will be printed as quickly

as possible and sent to Russia through the Soviet Embassy. If this volume is a success it is hoped to make it the first of a series. References and illustrations will be few, the aim being to produce a compact, informative and inexpensive book before the expected spring offensive begins. The object is not to try to teach the Russians anything (for they probably know far more about war medicine by this time than we do) but to say, in effect, "This is the way we do it. What do you think of it? And will you tell us about your own findings?" Thus the series may lead to an exchange of medical opinion which the profession in this country would greatly welcome. There are many things we should like to learn. For example, what standards do the Russians use in selection of troops? What is their age-limit for air pilots? Are they better provided than we are with rehabilitation and vocational training centres? Dr. S. Girgolov, in *Soviet War News*, the bulletin issued by the Soviet Embassy, says that for frostbite they use rapid heating of the affected part and physiotherapy, including ultrashort waves, and remove damaged tissues early, but he gives no details. He also says they are using closed plaster more and more, and are employing plasma for transfusion on a large scale. Have they had much gas gangrene? Have they used local sulphonamides widely and has their experience been the same as ours? How do they send their blood to the front line? How are they treating burns? Are they using local anesthesia for operations? Mr. Anthony Eden has already undertaken to try to arrange an exchange of information about typhus.

Many more questions spring to the mind on which shared experience would doubtless throw light; but apart from the written word what we should all like is a visit from a deputation of our Russian colleagues and the chance to exchange views and opinions and to establish a closer understanding which will help to found a lasting friendship.—*The Lancet.*

PAPER RESTRICTIONS AND THE BRITISH MEDICAL JOURNAL

THE course of the war since April, 1940, when Scandinavian sources of material for paper-making were cut off, has imposed progressive limitation upon supplies of paper, and this *Journal* in common with others has shrunk to small dimensions when judged by the standard of 1939. The shrinkage in number of pages was brought about gradually and some readers may have been scarcely aware of it until last week's very slender issue came into their hands. The reason for this attenuation is as simple as it is disagreeable. Our paper ration has suffered another and a much more drastic cut and we must eke out the supply which the Paper Control now allows us by printing fewer pages each week, and in future issues by diminishing still further the size of type used in various parts of the *Journal* and *Supplement*. Since this is a professional organ of information and opinion, owned by the members and not run for profit, the advertisement pages have to fare far worse under the axe than the editorial pages. The British Medical Association, unlike the proprietors of all newspapers and of most periodicals, can not compensate for dwindling paper supplies by materially cutting down circulation, because it is bound to send a copy of its *Journal* every week to each of the 40,000 members. Every effort will be made to economize space and to secure an adequate amount of paper, but readers and contributors must help us to make the best of a bad situation and be prepared for disappointments. The generous space given to correspondence will have to be curtailed, which means fewer and shorter letters. Every one in these days is putting up with things he never thought to endure, and we look confidently to members of the British Medical Association to exercise forbearance. As for conciseness, it has become a major virtue in all who put pen to paper.—*The British Medical Journal.*

SCIENTIFIC BOOKS

ACTIVITIES OF THE AMERICAN NATIONS

Statistical Activities of the American Nations. Edited by ELIZABETH PHELPS. Washington, D. C.: Inter American Statistical Institute. 842 + xxxi pp. 1941. $2.00.

THIS is a compendium of the statistical activities relating to the collection, processing and publication of social and economic data in the Western Hemisphere, prepared under the direction of the temporary organizing committee of the Inter American Statistical Institute. The major portion of the book consists of a series of twenty-two descriptive papers—one for each of the American republics—contributed by outstanding administrators of statistical services in the respective countries. Each of these papers gives, for the most part, a historical account of the development of statistical services in the nation concerned (in the language of that country) together with a description of the present status of statistical activities in that country. There is a considerable amount of variation in the degree of completeness of the various papers. In order to provide the reader with a ready means of making comparisons between the various countries, the editor has prepared a summary in English and also in Spanish of facts regarding the scope of the statistical work carried on in each country. A uniform set of subheadings is used for the summaries: Education Facilities; Statistical Library Facilities;

Statistical Societies or Associations; Non-Official or Semi-Official Statistical Agencies; System of Official Statistics; Principal Official Serial Statistical Publications.

An interesting and useful feature of the book is a biographical directory of the prominent statisticians (370 names) for all American nations except the United States. Appendix 1 is an excerpt from "The Economic Literature of Latin America," Harvard University Press. Appendix 2 is a report of the meeting of the statistical section of the Eighth American Scientific Congress, which was held in May, 1940.

This book is the first attempt to present a comprehensive account of what is going on statistically in North and South America. In view of the pressure of world events it is a timely document. It should at least serve to disseminate knowledge of the various statistical activities going on in the Western Hemisphere and to introduce important statisticians and statistical administrators in the hemisphere to each other.

S. S. WILKS

GLASS: THE MIRACLE MAKER

Glass: The Miracle Maker. By C. J. PHILLIPS, Corning Glass Works, Corning, N. Y. xii + 424 pp. 208 figures. 41 tables. New York: Pitman Publishing Corporation. 1941. $4.50.

"GLASS: The Miracle Maker" occupies a unique position in the relatively small library of books that are related to this subject. It can be roughly classified in a position intermediate between the type of book designed for a reader of popular science material and that intended for the glass technologist. For the former individual, the author suggests that the more technical chapters on chemistry and mechanical and physical properties be omitted if so desired. However, exclusive of these chapters, certain of the nomenclature employed in the remaining portions may cause the lay reader of science subjects some difficulty. Even with the inclusion of the aforementioned technical material the book can scarcely be considered sufficient in scope for use as a text by the student of glass technology.

The author in the foreword states: "This book is intended primarily, but not exclusively, for the architect, the civil, mechanical, electrical or chemical engineer, the industrial designer, or other industrial executive—in short, for those who may see in glass a unique and versatile material, interesting in its own right, and full of unexplored possibilities for creating products and improving production methods."

For these individuals the book has been wisely divided into two sections. Part One, devoted to History and Technology, includes the following topics: The History and Present Status of Glass; The Chemistry of Glass dealing with its constitution, composition and chemical durability; Mechanical and Other Physical Properties of Glass, including elasticity, hardness, strength, thermal endurance, density, coefficient of expansion, heat conductivity, viscosity and electrical and optical properties; Materials Handling, covering methods of unloading, storage, weighing, mixing and charging the raw materials that constitute a glass batch; Fuels, Refractories, Furnaces and the Melting Process; The Principles of Glassworking, including glass blowing, the production of mold ware, tubes and rods, casting and lamp-working; Glassworking Machinery; Finishing, Annealing, Decoration and Inspection.

In Part Two the author devotes over 160 pages to Applications and discusses the multitude of uses found for glass in architecture and building construction, in the home, in electrical transmission and communication, in illumination, in manufacture and in science and research. The last chapter considers the utilization of fiber glass. It is this latter portion of the book that is unique in its excellent portrayal of the rôle played by glass in modern civilization.

One of the outstanding features in "Glass: The Miracle Maker" is to be found in the some 150 excellent photographic illustrations. Particularly outstanding are those depicting "offhand" glass blowing and the Steuben art glass collection. Each chapter is ended with a list of references for further studying the subjects. These features go toward fulfilling the hope of the author that his book will meet the needs of engineers and industrial designers. The glass technologist himself may find in it a source of not too highly technical, yet interesting and perhaps profitable information.

The format is particularly attractive and a book mark of fiber glass is appropriately enclosed.

H. W. SAFFORD

UNIVERSITY OF PITTSBURGH

REPORTS

RESEARCHES AT MELLON INSTITUTE
1941–42

OUTSTANDING at Mellon Institute during the fiscal year ended February 28, 1942, has been the growth of the industrial research staff to 205 fellows (from 187) and 150 fellowship assistants (from 114). The services of these scientists and engineers have been required on the 95 industrial fellowships in operation.

The investigational exigencies of the emergency have in fact caused a considerable expansion in the activities of certain fellowships, particularly those concerned with coke by-products, and have resulted in many special studies for Federal Government agencies by various fellowships, such as those pertaining to heat-insulation, petroleum, plate glass, protective coatings, synthetic organic chemicals and tar synthetics. The range of the programs of most fellowships has regard for post-war economic problems. During the fiscal year from March 1, 1941, to March 1, 1942, the institute has expended $1,378,752 in carrying on its various pure and applied science projects. These particulars are brought out in the twenty-ninth annual report of the director, Dr. E. R. Weidlein, to the trustees of the institution.

In the institute's department of research in pure chemistry studies on the chemistry and chemotherapy of modified cinchona alkaloids and related synthetics have been continued. In the findings to date there has been no beneficial action of quinine which can not be accomplished equally well by hydroxyethylapocupreine, a drug which is greatly superior to quinine in pneumonia, in infections of the eye and throat and in certain asthmatic conditions. Because of the possible difficulty in obtaining adequate supplies of cinchona alkaloids, investigations are under way aimed at the production of simpler compounds which can be made from easily available materials. It is hoped that medically important chemicals can be prepared by the application of knowledge of the structural and biological relationships obtaining in the cinchona field.

In studies for the twelfth revision of the U. S. Pharmacopoeia different assay procedures for new synthetic organic chemicals have been evaluated. And much attention has been accorded to the chemical durability of glass containers for pharmaceutical solutions.

The projects subsidized by Mellon Institute at the Institute of Pathology of the Western Pennsylvania Hospital have related to chemotherapeutic and bacteriologic researches largely pertaining to the effects of the sulfonamides. A new sulfhydryl preparation has been found to possess utility in the treatment of burns. Work has proceeded on natural resistance and the common cold and on the role of certain enzymes involved in the metabolism of oxygen and carbon dioxide. The objective of the latter investigation is to acquire facts concerning the relation of these enzymes to the underlying metabolic disturbances associated with arthritis. Another program has been concerned with the bacteriology of subacute bacterial endocarditis.

Industrial Hygiene Foundation, a combined research and service association for health protection in the industries, which maintains its headquarters at Mellon Institute, is especially active these days. Battle lines in to-day's wars advance and retreat with production. The protection of industrial workers, who are forging the weapons, therefore becomes a supreme necessity, riveting attention on their health as never before in history. And rightly so, for increasing production tends to increase health hazards in industry. Unless successful remedies are swiftly applied, approximately one billion man hours will be lost through illness during 1942 when production means protection.

Investigations of Industrial Hygiene Foundation have pertained to the effects of arc-welding fumes on susceptibility to tuberculosis, to the reactions of living tissues to silica granules, to the appraisal of x-ray films for use in physical examinations in the industries and to the evaluation of present exhaust ventilation for the control of industrial health hazards. Since early in 1941 the foundation has been studying sick absenteeism in the industries. Fatigue is another topic that is getting constant consideration. The report also includes a review of the work on aluminum powder as a possible preventive in silicosis.

Nine new industrial fellowships started on their researches during the fiscal year: calcite technology, coke-plant construction materials, fur, lock-nut technology, naphthalene chemistry, packaging, pine chemicals, tape technology and tar constituents. Eight fellowships completed their investigational programs during the year. The annual publications consist of 5 bulletins, 34 research papers and 53 other articles. Fifty-three United States patents have been issued on fellowship inventions.

Of special interest is the information set forth regarding continued industrial fellowship researches. Anthrafloss is a high-grade mineral wool for insulating purposes made from anthracite by-products by the multiple fellowship of Anthracite Industries, Inc. The multiple fellowship on heat insulation and roofing has aided in the development of an efficient insulating material suitable for temperatures up to and including 1500° F. A prominent consequence of the research program of the multiple fellowship on plastic metals has been the construction of a large commercial sponge-iron plant. The activities of other fellowships have benefited gray cast-iron and steel production. Of pertinence here is the research of another fellowship on the refining of chromium. The multiple fellowship of the American Iron and Steel Institute has pursued steadily the utilization of waste pickle liquor. Research initiated by this fellowship has been conducted on five potential processes for the recovery

of values from this industrial waste; the investigational work includes the recovery of free sulfuric acid and copperas, the manufacture of iron carbonate and ammonium sulfate, the production of magnesium from low-grade ores by leaching with waste pickle liquor and the preparation of sodium sulfate and ferric chloride.

In the realm of ceramics, cast-iron enameling, hollow-ware enameling materials, flat glass and waste grinding sand from plate-glass manufacture are the projects of various fellowships. The multiple fellowship on plate glass technology has brought about substantial advances in methods for evaluating flatness and texture of surfaces. Garspar, Garcolite and Gartex are being made commercially from waste grinding sand as a result of the research and development work of the mineral products fellowship. New markets have been evolved for Garspar in the fields of pottery and glass; Garcolite has been used as a pulverulent aggregate in concrete; Gartex is a processed filler for rubber, plastics and paints.

The multiple industrial fellowship on sulfur has been devoting main study to sulfur cements, to the reaction of gaseous olefins with sulfur and to the employment of sulfur as a filtering medium. The efficiency of sulfur in removing sediment from water was found to equal or surpass that of sand filters. The multiple fellowship on gas by-products has made many new inorganic and organic thiocyanates. A novel series of rubber accelerators has been discovered by this group. Other fellowships are investigating the upgrading of the components of coke-oven light oil, the physical properties of tars and pitches and their improvement, new products from tars and problems of waste disposal in the by-product coking industry. A process has been devised for the commercial recovery of cyclopentadiene, of great interest as a potential copolymer in the preparation of synthetic rubber and resins. Several types of natural gasoline and casing-head gasoline have been shown to contain amounts of isobutane and isopentane which make them desirable for sources of alkylation materials and for the production of 100-octane grade aviation fuel. The feasibility of installing a butane extraction plant has been demonstrated; normal butane is useful in the manufacture of butadiene for synthetic rubber production.

The multiple fellowship on petroleum, which has been in operation since 1911, has had another year of creative activity. The study of the chemical constitution of high melting waxes has been carried onward as has also that of the overall chemical nature of crude petroleums. Another fellowship is probing the composition of petrolatum. The twenty-eighth year of the operation of the multiple fellowship on organic synthesis has followed the usual pattern of development of new products and utilization of these chemicals to meet changing demands of the industries. Investigations on the manufacture and applications of amines, detergents, lubricants, hydraulic fluids and synthetic resins have been lengthened with success. Research in oil additives has uncovered compounds having marked detergent and anti-oxidation properties. The search for successors for chemicals unobtainable because of the war has brought forth promising products. The physiological effects of new organic compounds are being investigated by the multiple fellowship on chemical hygiene.

Mellon Institute is also quite energetic in food and nutritional research. The multiple fellowship on food varieties has perfected a new type of instant baby cereal and several novel junior foods, and a project has been begun that will survey the whole field of food flavors. A process for the rapid tenderization of meat worked out by a fellowship is now in use in 2 plants.

A fifth year of success in cotton investigation has been had by the multiple fellowship sponsored by the non-profit Cotton Research Foundation, technical agency of the National Cotton Council of America. Studies on the fiber have received most attention; investigations on the practicability and on methods of adapting virgin cotton to the manufacture of high-grade papers have been continued; fundamental research on the properties and structure of cotton cellulose and on the influence of such processes as mercerization is being conducted by novel techniques. The studies on cottonseed began to mature in encouraging fashion during the past year. The industrial fellowship on felt has devised methods which impart to paper-machine felts and other woolen industrial fabrics markedly improved physical characteristics and resistance to chemical injury. This fellowship has also worked out a process for rendering wool and wool fabrics non-shrinking and non-felting, and an improved system of wool scouring and scouring-room control that has brought an average daily increase in production of better than 75 per cent. A third textile fellowship has made important advances in the processing of hosiery yarn, particularly nylon.

The fellowship on bone products has announced methods for obtaining higher yields and grades of glue; this fellowship has lately been studying granular adsorbents for use in sugar refining. The fellowship on rubber technology is increasing its staff for fundamental studies of underlying problems of the industry. Raolin, a special chlorinated rubber, the creation of another fellowship, is being allocated ac-

cording to Federal Government instructions and a substantial plant expansion program has been undertaken. Of interest in connection with needs for plastics is the program of the multiple fellowship that is engaged in research on polymerizable silicon compounds. The likely uses of these silicon derivatives are many and varied; certain applications have been proposed which have potential utility in warfare. Fellowship research is also being conducted on the employment of plastics in water and gas meters and for many other purposes.

W. A. HAMOR

SPECIAL ARTICLES

PHOSPHORYLATIVE GLYCOGENOLYSIS AND CALCIFICATION IN CARTILAGE[1]

PHOSPHORYLASE, an enzyme which catalyzes the reaction

Glycogen + inorganic phosphate ⇌ glucose-1-phosphate

(the first step in phosphorylative glycogenolysis in muscle and liver),[2] has recently been found in significant concentration in the epiphyses of growing rats and rabbits.[3] This enzyme can initiate conversion of the glycogen of hypertrophic cartilage cells into phosphoric ester substrates for cartilage (bone) phosphatase, and may thus play a significant role in the calcification of cartilage. We have investigated this by determining the effects of known inhibitors of the glycogenolytic cycle in muscle[4] upon *in vitro* calcification of cartilage (Table I).

M/100 phlorizin markedly, in some experiments almost completely, inhibited calcification of cartilage in solutions containing 8 mg per cent. Ca and 5 mg per cent. P as inorganic phosphate. M/200 phlorizin consistently caused partial but definite inhibition, M/2,000 phloretin almost completely blocked calcification. Adding glucose-1-phosphate to these solutions restored the capacity of cartilage to calcify well, even in the presence of phlorizin or phloretin. Since phlorizin and its aglycone, phloretin, principally inhibit phosphorylase activity,[4] these results imply that phosphorylase is not only present, but that its action (the formation of glucose-1-phosphate) is necessary for calcification of cartilage in a medium containing P as inorganic phosphate.

How the P of glucose-1-phosphate is then made available for the formation of bone salts apparently depends upon the activities of 3 enzymes present in calcifying cartilage: phosphorylase, phosphatase and phosphoglucomutase, all of which act upon this ester. Significant dephosphorylation of glucose-1-phosphate by phosphorylase is improbable, at least under the equilibrium conditions of *in vivo* calcification, because the glycogen stores of hypertrophic cartilage do not increase as bone salts are deposited, but disappear. Direct dephosphorylation of much glucose-1-phosphate by phosphatase is also unlikely, for reasons given elsewhere.[3] Equilibrium conditions apparently favor conversion of glucose-1-phosphate by phosphoglucomutase to glucose-6-phosphate and thereafter (by the glycolytic enzyme system known to be present in cartilage),[5] to subsequent phosphoric esters of the glycolytic series. Such, at least, is the implication of observations made by Robison and Rosenheim,[6] which we have confirmed: *in vitro* calcification of cartilage in a medium containing P only as inorganic phosphate is blocked by M/1,000 cyanide, by M/1,000

TABLE I

EFFECT OF INHIBITORS OF GLYCOGENOLYSIS ON *in vitro* CALCIFICATION OF CARTILAGE* WHEN P IS SUPPLIED AS INORGANIC PHOSPHATE, AND AS PHOSPHORIC ESTERS OF THE GLYCOGENOLYTIC SERIES (pH ADJUSTED TO 7.4; TIME 18 HOURS; TEMP. 37°C.)

Phosphoric ester added to calcifying solution†	Inhibitor	Calcification
None (inorganic P only)	none	++++
"	M/100 phlorizin	+
"	M/200 phlorizin	++
"	M/2,000 phloretin	±
Glucose-1-phosphate	M/100 phlorizin	+++
"	M/2,000 phloretin	+++
None (inorganic P only)	M/1,000 KCN	+
"	M/1,000 iodoacetate	+
"	M/10,000 NaF	±
Glucose-1-phosphate	M/1,000 KCN	+
"	M/1,000 iodoacetate	+
"	M/10,000 NaF	±
2-phosphoglycerate	M/100 phlorizin	+++
"	M/1,000 KCN	+++
"	M/1,000 iodoacetate	++++
"	M/10,000 NaF	±
α-glycerophosphate	M/100 phlorizin	+++
"	M/1,000 KCN	+++
"	M/1,000 iodoacetate	++++
"	M/10,000 NaF	++++

* We used the proximal ends of the tibiae of 20–22 day old male rats made somewhat rachitic by 8–12 days maintenance on a Steenbock-Black diet. Each tissue slice was placed in a tube containing 40 cc. control or calcifying solution, the tubes being gently rocked mechanically in a water-bath. The slices were then stained with silver nitrate.

† Solutions contained the control basal salt solution (⁶) plus 8 mg per cent. Ca as $CaCl_2$, plus 5 mg per cent. P as phosphate buffer, plus (where added) 10 mg per cent. P as phosphoric ester, plus (where added) inhibitor. All concentrations are those in the final solution. pH adjustments were made by choosing suitable phosphate buffers; where phlorizin or KCN were added, it was necessary to make further pH adjustments with $NaHCO_3$ resp. HCl.

[1] Supported by a John A. Hartford Fund Gift. We are indebted also to Dr. D. E. Green for certain phosphoric esters and for many helpful suggestions.

[2] C. F. Cori and G. T. Cori, *Ann. Rev. Biochem.*, 10: 151, 1941.

[3] A. B. Gutman and E. B. Gutman, *Proc. Soc. Exp. Biol. and Med.*, 48: 687, 1941.

[4] J. K. Parnas, "Glykogenolyse," in Handbuch d. Enzymologie, Leipzig, 2: 902, 1940.

[5] G. M. Hills, *Biochem. Jour.*, 34: 1070, 1940.

[6] R. Robison and A. H. Rosenheim, *Biochem. Jour.*, 28: 684, 1934.

idoacetate and by M/10,000 fluoride, concentrations too low to inhibit bone phosphatase or to affect the solubility of bone salts. The inhibition by fluoride, currently believed to prevent formation of phosphopyruvate from 2-phosphoglycerate by blocking the action of enolase, indicates that dephosphorylation by phosphatase does not take place prior to that stage in the cycle. Calcification of cartilage, accordingly, involves phosphorylative glycogenolysis at least to the point of phosphopyruvate formation.

An exacting test of the role of phosphorylative glycogenolysis in this connection can be made by determining the effect of various inhibitors upon *in vitro* calcification of cartilage when P is supplied as the several phosphoric esters of the glycogenolytic series. We find that calcification with glucose-1-phosphate, in concentrations of 10 mg per cent. P, is not inhibited by phlorizin but is inhibited by cyanide, iodoacetate and fluoride; calcification with 2-phosphoglycerate is not inhibited by phlorizin, cyanide or iodoacetate but is by fluoride; calcification with α-glycerophosphate is not markedly inhibited by any of these agents. These results are consistent with what is known of phosphorylative glycogenolysis in muscle.[4] If phosphoric esters not in the series but readily dephosphorylated by bone phosphatase (β-glycerophosphate, phenylphosphate) are used, good calcification is obtained, which can not be blocked by inhibitors of glycogenolysis. If phosphoric esters not in the series and not dephosphorylated by bone phosphatase are used, calcification does not occur.

Conclusions. Calcifying cartilage contains an enzyme system for phosphorylative glycogenolysis. This system constitutes part of Robison's "second mechanism of calcification."

The processes of phosphorylative glycogenolysis are essential for *in vitro* calcification of cartilage in solutions containing P only as inorganic phosphate. They provide a mechanism whereby in such a medium lacking preformed phosphoric ester substrate for bone phosphatase, a concentration of P can be effected locally at the site of calcification in the cartilage matrix.

This mechanism probably operates in normal, *in vivo* calcification of cartilage. It could account for the selective calcification occurring in glycogen-rich primary centers of fetal ossification before erythrocytes, the only adequate source of phosphoric esters hitherto recognized, appear at the site of calcification.

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THE MILK-INFLUENCE OF BREAST TUMORS IN MICE[1]

IN this report we wish to present further data on the characteristics of the active milk-influence which plays an important role in the development of spontaneous carcinoma of the mammary glands in mice.[2]

Details of the experiments were as follows. Lactating females of the cancerous A strain were killed on 2/6/41 and their mammary glands removed. The tissue was macerated in a tissue-press and forced through a disc having openings 0.045 of an inch. The macerated material was filtered, using a fine wire cloth and 38 cc of milk, etc., was obtained to which was added an equal amount of sterile physiological salt solution. The extract was filtered through a Seitz filter and the filtrate (called filtrate A) was injected subcutaneously or intraperitoneally into 15 mice of the fostered C3H strain. The incidence of breast tumors in breeding females of the fostered C3H strain is about 2 per cent. The injected animals, as were all the mice used in these studies, were four weeks of age at the time of treatment and each received 2 cc of the filtrate. Nine of the injected mice have developed breast tumors, one has died non-cancerous and the others are living. All the females in this and the following experiments were used as breeders.

To the macerated tissue and the unfiltered residue of filtrate A was added 40 cc of distilled water. The extract secured following filtering with a wire cloth was filtered through the Seitz filter. This filtrate (called filtrate B) was injected, as above, into 12 females of the fostered C3H stock. Ten mice have developed breast tumors.

To determine if the unfiltered material contained the active milk-influence, 17 fostered C3H mice were given, in small dishes, the unfiltered residue and the macerated tissue diluted 1:3 with water. The average amount given per mouse was 7 cc, and most of the material was consumed. Fourteen of these females have developed breast tumors, 2 are living and 1 died non-cancerous.

Mice receiving the filtrates developed tumors at an average age of 287 days and the females receiving the unfiltered extract at 244 days.

On 4/17/41, 75 cc of distilled water was added to 15 cc of macerated breast tumors (tissue-press). The extract was given by mouth to 13 mice of the fostered C3H stock and 6 females of the BAF_1 generation (C57 black ♀ × A ♂, normal incidence of breast tumors, 1 per cent.).[3] The average amount given per female was 3.8 cc. Nine fostered C3H and 1 BAF

[1] Assisted by grants from the National Cancer Institute and The Jane Coffin Childs Memorial Fund for Medical Research.

[2] J. J. Bittner, SCIENCE, 84: 162, 1936.

[3] *Idem*, Trans. and Studies of the College of Physicians of Philadelphia, 9: 129, 1941.

females have had breast tumors, 1 C3H mouse died at an early age and the others are living.

To the residue of the tumor-tissue was added an equal amount of 50 per cent. glycerin. This was placed in the refrigerator on 4/17/41, shaken daily and filtered through a wire cloth on 4/24/41. Twenty-five cc of filtered substance was obtained to which was added 40 cc of Locke's solution. The extract was injected intraperitoneally into 16 fostered C3H females (2 cc, each mouse) and 8 BAF_1 females (1 cc, each mouse). Five of the C3H females have developed spontaneous breast tumors; the others are living.

On 5/6/41 an extract of 30 cc of macerated tissue of spontaneous breast tumors and 90 cc of 50 per cent. glycerin was placed in the refrigerator, shaken daily until 5/15/41, when it was removed and filtered (wire cloth). Seventy-five cc of filtrate was obtained to which was added 140 cc of Locke's solution. Fifty-five mice were injected intraperitoneally, each receiving 1 cc. As 43 of the injected mice were dead by the following morning, the others were given the extract in small dishes. The average amount given was 4 cc per animal but little of the material was consumed in two days. Five BAF_1 and 7 fostered C3H females survived the treatment and tumors have been observed to develop in two of the hybrid animals.

Summary

Females of the fostered C3H strain and the BAF_1 hybrid generation, having a normal incidence of breast tumors of 1–2 per cent., were given, by mouth or injection, filtrates (Seitz filter) or extracts of glycerinated-treated tissue containing the active milk-influence for the development of spontaneous breast cancer. Sixty-three experimental mice were observed to have an incidence of 41 per cent. Thirty-six mice received unfiltered or untreated material and have had an incidence of 67 per cent. Many of the mice of each group are still living.

Previous studies indicated that the active milk-influence would not become inactive following desiccation.[4] Following ultracentrifugation the active influence appeared in traces, if at all, in the fat fraction and in the final supernatant fluid, and it is possible that the active agent is a colloid of high molecular weight.[5]

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

A MEANS OF INCREASING THE ILLUSION OF DEPTH IN PHOTOGRAPHS

PHOTOGRAPHS used in scientific illustration generally lack the illusion of depth or three dimensions. The recent introduction and use of film transparencies (translites) has made available a means of obtaining the third-dimensional effect in photographs. "Translites" when held up to the light and viewed from a distance of two or three feet give the optimum of third-dimensional illusion or effect.

An easy, inexpensive means of mounting and viewing the transparencies in front of the laboratory windows is herein described. The films are mounted in metal frames between two sheets of glass. The dimensions of the frames used by us are twenty-two by twenty-nine inches and they hold nine translite films (seven by nine inches) arranged in three rows of three each. The metal frames were obtained from the Multiplex Corporation of St. Louis, Mo.

The frames are held in front of the windows by the following means. Two deeply grooved wooden tracks or window bars are used to keep the frames upright in the lower part of the window. The lower grooved track is permanently fastened to the framework of the window. The upper detachable grooved track is fastened to the framework of the window by means of two bolts passing through holes at each end of the bar and fastened by wing nuts. The upper bar can easily be unfastened to insert the frame containing the translite films. Several frames may be placed in a window and the ventilation or illumination of the room is not appreciably decreased (see Fig. 1 A and B).

Since the films are placed between two sheets of glass, they are not liable to injury by frequent handling and therefore retain their usefulness indefinitely. This method of illustration had been found to be much superior to ordinary photographs and greatly enhances the illusion of the third dimension or depth in photographs.

"Translites" may be made on either translite film or paper (Eastman Kodak). The paper is less expensive than the film, but it does not have the same degree of brilliance or transparency. Each side of the translite film or paper is coated with a photographic emulsion. These emulsions are of different speeds so that when developed the two images are of different densities and are separated from each other by the thickness of the paper or film. The illusion of depth is thus readily obtained when these double-coated, two image films or papers are viewed from a distance of several feet.

Photographic negatives of medium contrast taken in the usual manner are used in making the translites.

[4] *Idem*, SCIENCE, 93: 527, 1941.

[5] M. B. Visscher, R. G. Green and J. J. Bittner, *Proc. Soc. Exp. Biol. and Med.*, 49: 94, 1942.

The same procedure is followed as in making ordinary enlargements on bromide or chloro-bromide papers except that translite film or paper is used instead.

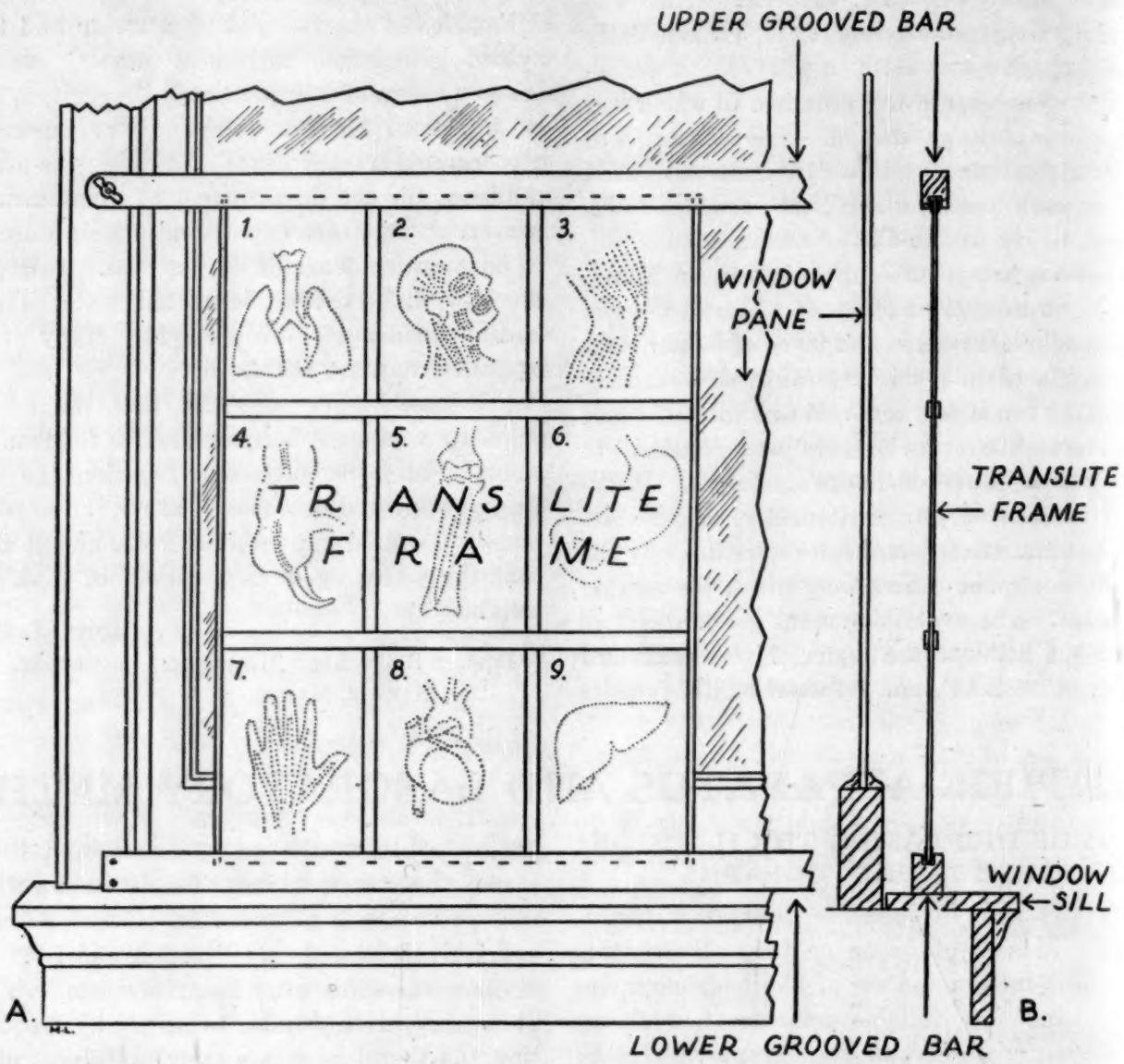

FIG. 1. Front (A) and cross-sectional (B) view of window frame with translites in place for viewing. The translite frame may be removed from the window by unscrewing the wing nut fastening one end of the upper grooved bar.

The translite film or paper requires no special technique in handling and developing. The development, the fixing and the washing of the translite film or paper is similar to that employed in preparing ordinary photographs. Wide variations in exposure of the translite film are possible since the translite film has a rather wide latitude.

Translites may easily be made to resemble the specimen more closely by the application of coloring pigments directly to either side of the film or paper. Eastman Transparent Oil Colors are best suited and should be used undiluted and applied directly with cotton applicators and then blended. Excess color may be removed easily by means of "thinner" applied in a similar manner.

Photography has been used as an inexpensive means of recording detail of preparations, etc., for further study. Ordinary photographs usually fail to create the illusion of depth so that it becomes difficult to determine the relationship of successively deeper planes to one another. The use of translites enhances the illusion of depth, and this means of mounting and illuminating translites is efficient and inexpensive.

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SCIENCE NEWS

Science Service, Washington, D. C.

THE BONES OF MEN AND APES

THE American Association of Physical Anthropologists at the recent meeting in Cambridge was addressed by Dr. Franz Weidenreich, of Peiping Union Medical College, leader in research on Sinanthropus, held by some investigators to be the most ancient of human species.

It has often been noted, according to Dr. Weidenreich, that the top skull bones of primitive human types are considerably thicker than the corresponding bones of modern skulls. But it has been rather generally overlooked that bones in the sides and base of the skulls compare in much the same way. Even the walls of the long limb bones show the same differences in thickness.

"When an average index is computed on the basis of nine measures of the main cranial bones the cranial wall of modern man is only half as thick as that of Sinanthropus, while the Neanderthalians possess three quarters of the thickness of the latter." The wall of the modern human thigh-bone shaft is only three quarters as thick as that of the Sinanthropus thigh-bone.

Apes, modern and ancient alike, fail to show this great thickness of skull and skeletal bones; however, Dr. Weidenreich pointed out that "there are some indications suggesting that massiveness of the bones must have been a feature peculiar to the common ancestor of hominids and anthropoids, with a tendency to undergo reduction in both lines." That is, in this one feature at least, the earliest known extinct species of man retain a character more primitive than is found in any ape species, modern or extinct.

THERMOPERIODISM

THAT plants need the daily rise and fall in temperature, as well as the daily changes between daylight and dark, to produce fruits and seeds, has been demonstrated by Professor Fritz Wendt, of the California Institute of Technology. The results of his experiments are expected to be of great value to commercial greenhousemen and other plant growers, in addition to their significance in the purely scientific study of plant growth and reproduction.

Professor Wendt worked mainly with tomatoes, in a series of air-conditioned greenhouse rooms where temperature as well as hours of exposure to light can be accurately controlled. One set of plants, kept day and night at an unchanging temperature of 26 degrees Centigrade (79 degrees Fahrenheit), supposed to be optimum for plant growth, did grow and blossom, but failed to set fruit. A parallel set of plants, given exactly the same living conditions except that the temperature was dropped about ten degrees Centigrade every night and raised again in the morning, set fruit abundantly. These plants also showed better general growth.

In other experiments it was found that even tropical plants, like orchids, respond in the same way to daily fluctuations in temperature.

What the internal physiological changes are that underlie these responses, Professor Wendt is not yet prepared to say. It seems, however, he ventured, that they may have something to do with the formation and translocation of food substances.

Somewhat similar responses to changes in hours of daylight, discovered about 20 years ago by Dr. W. W. Garner and H. A. Allard, of the U. S. Department of Agriculture, have been given the name "photoperiodism." It would seem appropriate therefore to give to the newly discovered temperature phenomenon the analogous name "thermoperiodism."—FRANK THONE.

CURARE

ONE of the deadliest of all poisons, used by South American Indians on their arrows to kill both game and enemies, will be made available in medicine as the result of studies reported at the Memphis meeting of the American Chemical Society by O. Wintersteiner and J. D. Dutcher, of the Squibb Institute for Medical Research.

The poison is known as curare, or more specifically as tube curare. It has long been known through study of arrow poisons obtained from the Indians, but because its source was uncertain, and because it was mixed with snake venoms and other foreign substances, its composition has remained a chemical puzzle and its medical use has been less dependable than physicians would like.

Like many other poisons, curare is a beneficial medicine when used in small enough doses. It is valued as a counteractant to metrazol, the shock-treatment drug now popular in medical circles, for "jolting" insane patients out of their unhappy state. Curare is also used in certain paralytic cases, to relax tightened muscles.

Messrs. Wintersteiner and Dutcher have succeeded in isolating the active principle of tube curare in crystalline form, which means they have obtained it chemically pure. In this condition it is four times more powerful than it is in the extract from which it was obtained. It is a white powder, and its chemical composition is expressed in the formula $C_{39}H_{44}O_6N_2Cl_2$. In such pure form, it is easily tested and its strength and uniformity of action can be maintained.

Tube curare is obtained from a vine of the upper Amazon and Orinoco valleys, known as Chondodendron tomentosum. It has no common name, but it is related closely to the ordinary moonseed, a wild vine frequently found in American woods.

A second kind of curare, known as calabash curare, quite different from tube curare, comes from an unrelated group of plants, another species of which is the source of the common poison, strychnine.—FRANK THONE.

THE SCIENCE CLUBS OF AMERICA

A NATION-WIDE search for scientific ability among boys and girls now in high school is to be conducted by Science Clubs of America, sponsored by Science Service.

Announcements of the distribution of more than $12,000 in scholarships and trips to Washington have been sent to principals of secondary schools throughout America and preparations are being made for preliminary examinations on or about May 15.

Outlines of Food Technology

by HARRY W. VON LOESECKE

Senior Chemist in Charge, U. S. Citrus Products Station, Winter Haven, Fla.

There has long been a need for a comprehensive volume covering the essentials of modern practice in the preparation and handling of foods; and the problems arising from the war have accentuated this need. This book is designed to serve both as a reference work for those engaged in all phases of the food industries, and as a textbook for use in connection with the courses in this field which are being added to educational curricula all over the country. Such pertinent matters as the respective merits of tin cans and glass containers, quick-freezing, and dehydration of vegetables are discussed, as well as fortified milks and wheat flour. Chemical analyses of the more important products are given, and a handy list of references for further reading is appended to each chapter. A feature of this handsomely bound volume is the large number of well-chosen illustrations, including original line drawings executed by the author.

Mr. von Loesecke is a native of New England and a graduate of Harvard University. In addition to supervising the work of the Citrus Products Station at Winter Haven, Florida, he has contributed numerous technical articles to leading chemical publications. At present he is carrying on research for the U. S Department of Agriculture's Western Regional Laboratory in California.

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The Tin Can and Glass Container. Fruits and Their Products. Canning of Vegetables. Dairy Products. Meat, Meat Products and Poultry. Fish and Shellfish. Grains and Their Products. Edible Fats and Oils. Sugars and Starches. Nuts. Spices, Relishes, Essential Oils, and Extracts. Beverages. Confectionery, Jams, Jellies, Preserves and Certified Dyes. Storage and Marketing of Fruits and Vegetables. Preservation of Foods by Freezing. Index.

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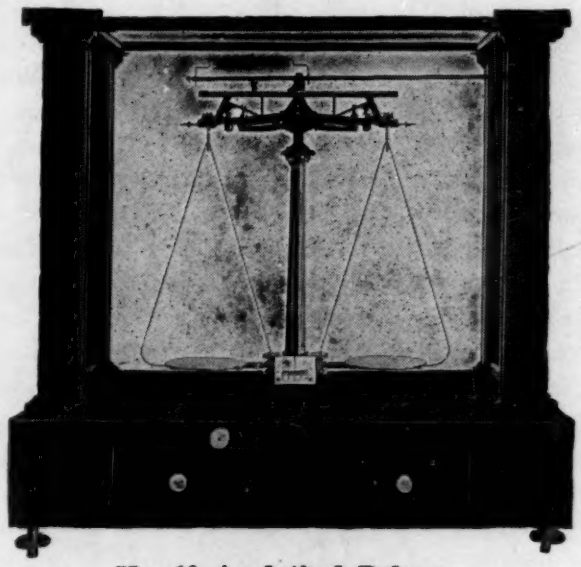

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The First Annual Science Talent Search, made possible by the Westinghouse Electric and Manufacturing Company as a contribution to the advancement of science in America, provides forty all-expense trips to Washington for a final examination with awards of eighteen Westinghouse Science Scholarships of $200 each and two Westinghouse Science Grand Scholarships of $2,400 each. One boy and one girl will be selected as winners of the Grand Scholarships.

The Science Talent Search is designed as a major step toward preventing diversion of America's potential scientific talent to tasks in war and peace which can be done just as well by those who do not have this talent. Boys and girls now in high school will be given an opportunity to develop their creative abilities so that in the next five years they may be able to take leadership in scientific research and engineering.

Objectives of the Science Talent Search are stated as: 1. To discover and foster the education of boys and girls whose scientific skill, talent and ability indicate potential creative originality and warrant scholarships for their development. 2. To focus the attention of large numbers of scientifically gifted youth on the need for perfecting scientific and research skill and knowledge so that they can increase their capacity for contributing to the task of winning the war and the peace to follow. 3. To help make the American public aware of the role of science in war and in the post-war reconstruction.

Each contestant will submit an essay of not more than 1,000 words on the subject: "How Science Can Help Win the War." It may describe a project in which the pupil has engaged or desires to engage, or it may contain an original idea, suggestion or invention of possible use to our armed forces or industry. Sketches or photographs may be submitted but are not required. Forty contestants, judged to have the best essays, will be invited on all-expense trips (transportation, hotel and other arranged expenses paid) to Washington, D. C., and return. All contestants invited to Washington will receive the Gold Emblem of Science Clubs of America.

Each scholarship may be applied toward a course in science or engineering at a degree-granting institution of higher education selected by the winner and approved by a Scholarship Committee named by Science Service. Science and engineering courses that may be pursued are those encompassed in the fields of activity of the National Academy of Sciences and the National Research Council.

ITEMS

TINY meteorites, "pebbles from heaven," weighing less than a 300th of an ounce have been discovered in Arizona by use of the magnetic needle. Since last spring, Dr. Frederick C. Leonard, associate professor of astronomy at the University of California at Los Angeles, has been experimenting with this method. Under certain conditions, he states, meteorites can be discovered when buried ten or twelve feet in the ground.

A NEW chemical, ammonium sulfamate, for killing poison ivy was tested last year by John Callenbach and John Carpenter, of the University of Wisconsin, who mixed it at the rate of one half pound to one pound per gallon of water. They applied about a gallon of spray to each 100 square feet of orchard area last June. The chemical probably would not be safe for use near lawn grass. If the poison ivy fails to come back this season, the ammonium sulfamate treatment will be considered completely successful. A coarse spray was used to keep it from drifting, the spray gun was held as low as possible and the spray was directed just over the top of the ground cover. They used a spray gun equipped with a No. 7 disc and a pump pressure of 200 pounds. In Wisconsin the ivy-killer will be of particular interest to orchard owners and workers.

HOPE that sulfadiazine, one of the newest of the sulfa drugs, can be used to ward off whooping cough in children who have been exposed to the disease appears in the Public Health Reports by Dr. John W. Hornibrook, of the U. S. Public Health Service and National Institute of Health. When sulfadiazine was given to mice one hour before a small dose of whooping cough germs was dropped into each mouse's nose, the germs failed to grow in 19 out of 20 mice, although they did grow in 10 out of 14 untreated mice. Whether the drug would have the same effect in stopping growth of whooping cough germs that invaded a child's nose has not yet been determined. When the sulfadiazine was given to the mice after the dose of whooping cough germs, it failed to stop the growth of the germs, suggesting that the drug would not be effective as treatment for whooping cough once it developed.

THE possibility that by electrical stimulation of the eye, it may be possible to distinguish between blindness due to disease of the retina and blindness caused by disease of the optic nerve has been suggested by Dr. H. D. Bouman, of the University of Rochester. When a very faint, barely perceptible electric current is applied to the normal eye, an effect is noted when the intensity of the electric stimulation changes. This is due to action of the nerve fiber. Three patients with almost total blindness were examined by Dr. Bouman by the electric stimulation method. One of them showed complete loss of electric excitability in the blind eye; this patient suffered from one-sided neuritis of the optic nerve. The other two showed excitability, but the response was like that of dark-adapted eyes even though the patients were examined in broad daylight. These cases had diseases of the retina, not of the optic nerve.

A PLAN aimed at making the new Sister Kenny treatment for infantile paralysis more generally available is announced by the National Foundation for Infantile Paralysis. The treatment was originated and introduced into this country by Miss Elizabeth Kenny, an Australian nurse. Under the foundation plan, the University of Minnesota will arrange to teach certain physicians, physiotherapists and nurses Sister Kenny's technique. Later foundation chapters will extend such training in cooperation with local agencies such as hospitals and health departments. The limited number of trainees will depend upon the number of patients in the early stage of the disease being treated at Minneapolis hospitals. The Kenny treatment is confined to such cases. Both the foundation and the university are "doing all that is humanly possible to spread knowledge about this method of treatment of the acute stage of the disease."